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The impact of the structure of taxes and public expenditure on income distribution inequality

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Vita

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Abstract

In the literature, most of the authors conclude that public spending and direct taxes reduce income inequality while indirect taxes increase inequality. However, fiscal policies have a different impact in different countries. This work intends to provide an analysis of how different fiscal policy instruments affect the income distribution. In this sense, the main objective of this work is to theoretically inspect and also to empirically assess how the tax structure (e.g., direct and indirect taxation) and the public spending structure (e.g., expenditures on education, health, social protection) affects income inequality, based on the set of countries usually designated in literature by PIIGS (Portugal, Italy, Ireland, Greece and Spain) and comparing these countries with the EMU core (Austria, Finland, France, Germany and the Netherlands), for a time period of 20 years (1996-2015). For doing so, we will follow the methodology used by Ramos and Roca-Sagales (2008), based on a vector autoregression model (VAR). The main results obtained through the VAR estimation is that: i) in PIIGS, the health expenditures, indirect taxes and social security contributions have a positive effect on output; ii) in core countries, the spending on social protection has a negative effect on output, although the education spending and indirect taxes have a positive effect on output; iii) in PIIGS, social security contributions have a positive effect on income inequality while spending on education and health has a negative effect, reducing income inequality; iv) in central European countries, spending on social protection has a negative effect on inequality while spending on "others" has a positive effect, increasing inequality; v) the link of GDP to Gini is more significant and negative in the PIIGS and, on the reverse causality, the Gini has a positive impact on the GDP growth in PIIGS, but a negative impact on the growth rate of the core countries.

Keywords: income inequality, fiscal policy, public expenditure, tax policy

JEL Codes: D30, D63, H20, H50

Resumo

Na literatura existente, a maioria dos autores concluem que os gastos públicos e os impostos diretos reduzem a desigualdade de rendimentos, enquanto que os impostos indiretos aumentam a desigualdade. No entanto, as políticas orçamentais têm um impacto diferente em diferentes países. Este trabalho pretende fornecer uma análise de como diferentes instrumentos de política orçamental afetam a distribuição de rendimentos. Nesse sentido, o objetivo principal deste trabalho é analisar teoricamente, e também avaliar empiricamente como a estrutura dos impostos (por exemplo, impostos diretos e indiretos) e a estrutura dos gastos públicos (por exemplo, gastos com educação, saúde, proteção social) afetam a desigualdade na distribuição de rendimentos, tendo por base o conjunto de países usualmente designado na literatura por PIIGS (Portugal, Itália, Irlanda, Grécia e Espanha) e comparando estes países com os países do centro da Europa (Áustria, Finlândia, França, Alemanha e Holanda) durante um período de 20 anos (1996-2015). Para tal, segue-se a metodologia utilizada por Ramos e Roca-Sagales (2008), baseada num modelo de Vetores Autorregressivos (VAR). Os principais resultados da nossa análise são: i) nos PIIGS, os gastos em saúde, os impostos indiretos e as contribuições para a segurança social têm um efeito positivo no produto; ii) nos países do centro da Europa, os gastos em proteção social têm efeitos negativos no produto, enquanto que os gastos em educação e os impostos indiretos têm um efeito positivo no produto; iii) nos PIIGS, as contribuições para a segurança têm um efeito positivo na desigualdade de rendimentos enquanto que os gastos em educação e saúde têm um efeito negativo, diminuindo a desigualdade de rendimentos; iv) nos países do centro da Europa, os gastos em proteção social têm um efeito negativo na desigualdade enquanto que os "outros" gastos têm um efeito positivo, aumentando a desigualdade; v) a ligação do PIB para o coeficiente de Gini é mais significativa e negativa nos PIIGS, e, na relação inversa, o coeficiente de Gini tende a apresentar uma relação positiva no o crescimento do PIB nos PIIGS, mas uma relação negativa no crescimento do PIB nos países do centro da Europa.

***Palavras-chave*:** desigualdade de rendimentos, política orçamental, gastos públicos, estrutura de impostos

***Códigos JEL*:** D30, D63, H20, H50

Table of Contents

List of Tables

List of Figures

Abbreviations

ADF - Augmented Dickey-Fuller

CIT – Corporate Income Taxes

EMU – Economic and Monetary Union

GDP – Gross Domestic Product

OECD - Organization for Economic Co-operation and Development

PIIGS – Portugal, Italy, Ireland, Greece, Spain

PIT – Personal Income Taxes

PP – Phillips-Perron

PPT- Petroleum Profit Tax

SSC – Social Security Contributions

VAR – Vector Autoregressive

VAT – Value Added Tax

1. Introduction

Income distribution is unequal, both in developed and developing countries. According to Martínez-Vázquez *et al.* (2012), based on data from the World Income Inequality Database, from 1970 until the mid-1980s, income inequality of a set of developing and developed countries decreased at an accelerated rate. After having stabilized in the mid-1980s, inequality has increased dramatically, especially in the beginning of the 1990s. Unweighted and weighted by the GDP, Gini coefficients showed decreases in the early 2000s, although the population weighted Gini continued to increase. Still without available data for many countries, Martínez-Vázquez *et al.* (2012) argue that inequality is expected to increase after the financial crisis of 2008.

While income inequality has been increasing in many advanced economies, fiscal policies have played a key role in trying to reduce income inequality over recent decades through instruments such as transfers, taxes and government expenditures. These instruments are needed to reduce inequality, making sure that no group is left behind regarding development. However, according to, for example, Bastagli *et al.* (2012), their redistributive impact has diminished since the mid-1990s.

In this context, the research question of this dissertation is to analyze the impact that government revenue and government spending have on income distribution, namely: i) which mechanisms operate from (different) government expenditures and revenues to income inequality? ii) are these mechanisms different, meaningfully affecting fiscal policy impact on inequality? This dissertation will provide a joint analysis of the output of fiscal policy and looks at the different incidence of policies from both the expenditure and the revenue side. Thus, the main objective of this work is to theoretically inspect and also to empirically assess how different fiscal policy instruments affect income distribution.

This dissertation intends to contribute to the literature on the relation between fiscal policy and income distribution inequality. First, there is still no systematic review for recent years; due to the financial crisis and the great recession since 2008 until 2012 there have been many changes in the economies and it is important to analyze how these changes affected the effectiveness of different fiscal instruments on income inequality. We propose to study such relation using more recent data. Second, as far as we know, there is no comprehensive review on compared mechanisms of different fiscal policy instruments on income inequality as we intend to do. Third, most of the literature computes fiscal policy income multipliers

while we propose to disentangle income and inequality multipliers of fiscal policy. An inequality multiplier measure the impact on income distribution inequality (measured by Gini coefficient, in our case), of a variation on revenue and expenditures of Government.

One of the main conclusions in the literature is that the impacts of taxation and public spending in income distribution differ across the countries. For example, comparing Europe with Latin America, "*the redistributive impact of the fiscal system is very large in Europe and very small in Latin America and where fiscal redistribution is significant, it is achieved mostly through transfers rather than taxes*" (Goñi *et al.*, 2011, p. 1). Given that, and since most of the empirical work assessing this relation is based on data for a single country, we propose to rely on a panel data for the so-called PIIGS countries. The PIIGS countries is a set of the five most vulnerable Eurozone economies during the crisis that started in 2008-2009. This group includes Portugal, Italy, Ireland, Greece and Spain. In 2014, according to data from OECD database,[1] PIIGS countries are those with the highest level of inequality. Spain, Portugal, Ireland, Greece and Italy are at the top of this negative ranking. In this work, we will also do a benchmark of these countries with the core countries: Germany, France, Netherlands, Austria and Finland.

Summing-up, this work aims at analyzing the mechanisms through which the tax structure (*e.g.*, direct, indirect taxation) and the spending structure (*e.g.*, expenditures on education, health, social protection) affects income inequality and quantitatively assess their effect on income inequality in PIIGS countries, comparing with the core countries.

The structure of this dissertation is as follows. After introduction, section 2 presents a review of the literature on the relation between public spending, tax structure and income inequality. In section 3, we describe the empirical methodology adopted in this study, as well as the detail of the variables and the data sources used in the construction of the database. In section 4, will be presented and discussed the results obtained, that includes the analyzes of the impulse response functions and the fiscal multipliers. Finally, section 5 presents the main conclusions of this study.

[1] http://www.oecd.org/social/income-distribution-database.htm

2. Literature Review

2.1. Inequality and Fiscal Policy

There are several types of inequalities: political inequality (*e.g.*, civic inequality and inequality before the law), economic inequality (*e.g.*, inequality of income and wealth), inequality of opportunity (*e.g.*, inequality of access to education, health services), inequality of treatment (*e.g.*, inequality of agency and responsibility) and inequality of membership in society (Mount, 2008).

In this dissertation, we will focus on the definition of economic inequality, and particularly in income inequality. Income inequality corresponds to the unequal distribution of household or individual income across the participants in an economy. It's the existence of disparities in income distribution, that is, the existing gap between incomes of the richest and those of the poorest.

Now, it's important to distinguish different concepts about the income. Disposable income corresponds to the amount of money that households have available for invest, consume and save after income taxes have been accounted for. On the other hand, market income corresponds to the amount of money that households have available before income taxes have been accounted for. So, market income inequality corresponds to income inequality before transfers and taxes and disposable income inequality corresponds to income inequality after transfers and taxes. Thus, it is expected that the inequality of disposable incomes varies more across countries than market income inequality.

There are various ways of measuring the income inequality. The choice of a measure does not change significantly how inequality looks like. However, changes in inequality over time within individual countries can look different if different measures are used. We can measure the income inequality through the ratio measures, that compares how much income people at one level of income distribution have compared to people at another level. S80/S20 is the ratio of the average income of the 20% richest to the 20% poorest; P90/P10 is the ratio of the upper bound value of the ninth decile (i.e. the 10% of people with highest income) to that of the first decile; P90/P50 is the ratio of the upper bound value of the ninth decile to the median income; and P50/P10 is the ration of median income to the upper bound value of the first decile. Another way to measure the income inequality is through the Palma ratio, that corresponds to the share of all income received by the 10% people with highest disposable income divided by the share of all income received by the 40% people

with the lowest disposable income OECD (2018).

Among other several measures of income inequality, the Gini coefficient is of most widespread use. For instance, Martínez-Vázquez *et al.* (2012) use this indicator to analyze the impact of government taxes and expenditures on income distribution. The Gini coefficient compares the cumulative proportions of the population against the cumulative proportions of income they receive, and takes values between 0 and 1: if the Gini coefficient is equal to 1, it means that all the income is held by a single person; if Gini coefficient equals 0, it means that income is equally shared among population (perfect equality). Thus, the lower is the Gini value, the more equal a society is. The Gini coefficient can be computed relying on gross income or market income (before taxes and transfers) or disposable income (after taxes and transfers). The Gini will change depending on what is measured. Most of authors measure the impact of the government spending and the government revenue on income inequality as the difference between the gross income Gini and the disposable income Gini: when countries face a faster rate of increase in net Gini coefficient than in gross Gini coefficient, it indicates a decrease in the distributional impact of fiscal policy (Odusola, 2017).

Now, regarding to fiscal policy, this is the primary tool through which Governments can affect the income distribution. Both revenue and Government expenditure may change the distribution of income, both in the short and medium term (Kyriacou *et al.*, 2016). The redistributive potential of fiscal policy plays an important role in reducing inequalities and increasing long-term growth. This efficiency eases budgetary constraints by facilitating higher levels of redistribution at certain levels of expenditure and taxation. That is, countries with strict fiscal rules have a better redistribution because of the stabilizing effect of these rules on fiscal policy (Kyriacou *et al.*, 2016). According to Cevik and Correa-Caro (2015), fiscal policy requires a series of structural reforms that aim to sustain economic growth as well as a greater access to all segments of society.

Fiscal policy has contributed to changes in income inequality in most countries (Cevik and Correa-Caro, 2015). However, their impact is different across the countries. Some countries use their tax and transfer systems to redistribute market incomes much more significantly than other countries (Michal, 2018). For example, in European Union, the tax and benefit systems vary significantly in size and structure (Paulus *et al.*, 2009).

Since mid-1990s, tax and benefit systems have become less redistributive in many countries. Cash transfers and income taxes reduce income inequality for a quarter of the working-age population. The main reasons for the decreased of the capacity of redistribution

are on the side of the benefits due to cuts in expenditure of social protection and the breakdown of transfers to lower income groups (OECD, 2012). Immervoll and Richardson (2011), also find that tax-benefit policies had become less effective in redistribution. In contrast, Wang and Caminada (2014), did not find that tax-benefit policies had become less effective in redistribution since the mid-1990s. They found that among the total population, both primary income inequality and redistribution continued to rise after the mid-1990s. Thus, the tax-benefit systems in the mid-2000s were even more effective at reducing inequality compared with the mid-1990s (Wang and Caminada, 2014). According to these authors, between the mid-1980 and mid-2000, the redistribution system (cash transfers and direct taxes) offset two-thirds of the increase in income inequality. The total redistribution increased, driven by the stronger redistributive effect of transfers. Regarding to direct taxes, in some countries the capacity of these taxes have declined. So, the trend of overall redistribution was caused mainly by transfers (Wang and Caminada, 2014).

Before presenting some findings, it is important to define the concept of progressivity and regressivity. Following Chu *et al.* (2000), the government spending is progressive (regressive) if the benefits to the bottom quintile are larger (smaller) than the benefits to the top quintile, relative to their income or expenditure. So, with progressive spending, benefits represent a smaller fraction of income or expenditure at a higher income or expenditure quintiles (Chu *et al.,* 2000). Regarding to taxes, a progressive tax is defined as a tax whose rate increases as the payer's income increases, that is, individuals who earn high incomes have a greater proportion of their incomes taken to pay the tax. On the other hand, a regressive task is one whose rate increases as the payer's income decreases.

Afonso *et al.* (2008) found that the level of taxation and progressivity is the most direct factor in terms of Government impact on the distribution of income. And with a correct progressive redistribution system, greater inequality automatically leads to more redistribution, even if no policy action is taken (Immervoll and Richardson, 2011).

According to Rodrigues and Arnold (2015), the tax and benefit system reduces the inequality. They concluded that the tax reforms helped in increasing the progressivity of the tax system. And the transfer payments (especially non-pension benefits) are also reducing the inequality. However, there is a series of adjustments that could strengthen the role of equalizing benefits system, which is usually biased towards benefits for seniors, while families with children should receive more support. According to these authors, without redistribution through taxes and transfers, inequality would be far greater, hence the

importance of public policies. For example, comparing Portugal with other OECD countries, these have stronger reductions in inequality through taxes and transfers. That is, this suggests that there are still things to be done to improve equity through social policies.

Fiscal policy instruments can play a very important role in making income distribution more equal. According to Carter and Matthews (2012), it is very important to increase revenues to finance the public expenditure on transfers, education and health, that tend to favor families with low income. But fiscal policies cannot always achieve their goals: the study by Troiano (2017) shows that the introduction of some tax policy reforms generated income inequality in United States throughout the 20th century, instead of promoting the correction that policy makers intended to.

So, different instruments have different impacts on different countries, that produces different results. Most of the authors conclude that public spending and direct taxes reduce income inequality while indirect taxes increase inequality. And, it is expected that an increase of indirect taxes is regressive, but the overall impact of a tax policy can be progressive if these effects are to be compensated with benefits, that is, the distribution of the disposable income depends both the tax side and on the expenditure side.

Another important notion, that is related with fiscal policy instruments and income inequality, is that of fiscal space. According to Botev *et al.* (2016) this is the gap between actual debt and estimated levels at which market access would become compromised. An increase in fiscal space means an increase of "room to maneuver", fostering productivity and long-term growth (Botev *et al.*, 2016). Odusola (2017) concludes that the relationship between fiscal space and the market and disposable Gini coefficients suggests that there is some tax regressivity. Both Gini coefficients are positively correlated with the fiscal space. In OECD countries, fiscal space has risen and structural reforms are key to help increasing fiscal space (Botev *et al.*, 2016). Also, structural reforms that effectively contain the cost of healthcare and pension spending create additional space (Odusola, 2017). Taking countries in Africa, it can be concluded that there is a need to improve the progressivity of taxes in countries with large fiscal space and high income inequality and for this, it is necessary get more revenues from personal and corporate income taxes. So, the progressivity of the direct and indirect taxes as well as an efficient and targeted public spending for education, health, agriculture are vehicles to reduce income inequality (Odusola, 2017). According to Michal (2018), if there is fiscal space, more generous welfare transfers to families in need could mitigate the distributional consequences of recessions.

In the following sections, will be presented more detailed conclusions of the different instruments of fiscal policy (both on expenditure and revenue side).

2.2. Taxes and income distribution

The overall redistributive impact of taxes depends on the amount of taxes collected (size effect) and the progressivity of taxes.

As we said before, the progressivity of taxes means that taxes must burden who has greater wealth, that is, it should be graduated according to the abilities of each person. In this case, the percentage of tax increases according to the capacity of the consumer - there are varying and increasing percentages. So, it's to be hoped that the progressivity of taxes can help to combat inequality in income distribution (for example, income taxes tend to be progressive).

In this section, first, we will analyze the impact of direct taxes and then the impact of indirect taxes on income inequality, following the explanation with some cases studied in the literature.

In regards to direct taxes, Sung and Park (2011) state that the income taxes are usually the larger share of direct taxes, and as they have a very progressive structure they have a positive and strong redistributive income effect.

Martínez-Vázquez *et al.* (2012) and Cubero and Hollar (2010) show that personal income taxes (PIT) improve income distribution and this impact increases with more progressive tax structure. According to Akgun *et al.* (2017), these type of taxes represent the major role in determining inequality, although other types of taxes are also important. In line with this, according to Paulus *et al.* (2009), personal taxes have the largest redistributive impact in most of countries, but contrary to what would be generally expected, Paulus *et al.* (2009) found that Estonia does not show a drastically equalizing effect from personal income taxes.

In relation to corporate income taxes (CIT), Martínez-Vázquez *et al.* (2012) conclude that this type of taxes also improve income distribution, but this effect is reduced in open economies, that is, this effect is smaller with more globalization. Akgun *et al.* (2017) conclude that, statistically, the effects of CIT on the distribution of income are very small.

Ramos and Roca-Sagales (2008), Suoniemi *et al.* (2008), Muinelo-Gallo and Roca-Sagales (2011) and Muinelo-Gallo and Roca-Sagalés (2013) also show that direct taxes reduce

inequality due to the progressive structure, that is, an increase in direct taxes will produce a bigger redistributive effect and, consequently, lower inequality.

However this impact of direct taxes on inequality is not linear across countries. While comparing the cases of Europe and Latin America, Goñi *et al.* (2011) show that direct taxes decrease income inequality. Yet, they also found that the impact of direct taxes is higher in Europe than in Latin America, that is, it reduces more the inequality in Europe than in Latin America. In contrast, Martinez-Vazquez and Vulovic (2014) show that, unlike most of countries, in Latin America (region that shows a considerable diversity in terms of tax structures), direct taxes don't play an important role in reducing inequality. Accoding to Cubero and Hollar (2010), another exception case is Central America, especially Panama. In Central America, the tax systems are generally regressive and the degree of overall tax regressivity varies substantially across the countries. Particularly in Panama, where the income taxes considered are strongly progressive and account for a greater share of total tax revenue, their low tax rates in income results in a small redistributive effect.

Now, regarding indirect taxes, Martínez-Vázquez *et al.* (2012), show that the general consumption taxes have a negative impact on income distribution, increasing the income inequality, because *"as indirect taxes are ultimately paid by consumers, and lower income groups spend a higher share of their incomes, relatively higher reliance on general sales taxes, excises and/or customs duties is generally expected to result in higher real income inequality"* (Martínez-Vázquez *et al.,* 2012, p. 23). Bastagli *et al.* (2012) and Koske *et al.* (2012) also show that indirect taxes, and particularly consumption taxes, tend to be regressive, increasing inequality. However, according to Muinelo-Gallo and Roca-Sagalés (2013), indirect taxes don't have a significant effect on inequality. Also, Sung and Park (2011) show that the effect of consumption taxes on redistribution is small and insignificant.

Cubero and Hollar (2010) also found that Value Added Tax (VAT) is regressive, that is, tends to increase income inequality. Akgun *et al.* (2017) concluded that, statistically, the effects of VAT on income distribution are very small. But although VAT has no statistical relation with income inequality, it may have distributive consequences on consumption, being slightly progressive. Although, according to Sung and Park (2011), the VAT burden is the greatest among all the taxes and it is regressive, it does not have a redistributive effect because the VAT burden is nearly proportional.

According to these ideas, Goñi *et al.* (2011) also show that the indirect taxes contribute to increase the inequality in income distribution (in line with most of the authors). Despite

their regressive effect, they also show that this impact is bigger in Europe than in Latin America. That is, in Europe it increases the income inequality more than in Latin America.

Considering the aggregate effect of direct and indirect taxes, Ramos and Roca-Sagales (2008) show that the effect on inequality of direct taxes is offset by the effect of indirect taxes, that is, direct and indirect taxation have opposite effects on inequality. While revenues from indirect taxes are lower than those from direct taxes, indirect taxes have a larger effect on inequality due to their degree of regressivity compared with the progressivity of direct taxes. Another example is the study done by Goñi *et al.* (2011), that found that both in Europe and in Latin America, the impact of taxation on inequality is quite small because the regressiveness of indirect taxes neutralizes the progressive impact of direct taxes.

According to most authors, a more egalitarian distribution of income requires a more progressive tax system, that is, it generally means that direct taxes need to be more important than indirect taxes in tax systems. However, in contrast with this, Martinez-Vazquez and Vulovic (2014) found that Latin America is an exception. In addition to having a more unequal distribution of income than the rest of the world, tax systems in Latin America for the most part have been found to be regressive and therefore adding to the inequality in income distribution (Martinez-Vazquez and Vulovic, 2014).

2.3. Public spending and income distribution

The overall impact of public spending on income distribution depends on the magnitude of social spending and its allocation across income groups.

Ramos and Roca-Sagales (2008) conclude that an increase in public spending reduces inequality, being the effect of current spending much larger than that of public investment. In regards to current public expenditure, Muinelo-Gallo and Roca-Sagales (2011) conclude that they reduce inequality because this type of spending includes different social spending with distributive implications through their immediate benefits.

In contrast, Cevik and Correa-Caro (2015) found that, in China, government spending is a statistically significant factor with a worsening effect on the distribution of income. This reflects the fact that the government spending in China is low and dominated by infrastructure investment and public administration.

As for the functional classification of public spending, Martínez-Vázquez *et al.* (2012) show that expenditures on health, education, social welfare and housing have positive

impacts on income distribution. They also conclude that the effects of expenditures on health and housing on reducing the income inequality are higher than those from expenditures on education and social protection.

In accordance with Martínez-Vázquez *et al.* (2012), Woo *et al.* (2013) and Paulus *et al.* (2009), also found that social benefits are associated with lower inequality. This positive contribution of government social benefits spending to income distribution may occur through two channels. First, part of social expenditure consists of direct transfers to the poorest, increasing their income and redistributing income from the richer to poorest. The second is that social expenditure may promote access for the poorest to higher degrees of education.

In regards to speding on social protection, Cubero and Hollar (2010) found that public spending on social protection is regressive, due to the spending on pensions. They found that social insurance programs are regressive, that is, they contribute to increase the income inequality. They concluded that, if social security is excluded, social spending is progressive. Lindert *et al.* (2006) also found that spending on social protection is regressive due to a truncation in coverage due to requirements of membership in formal labor markets which exclude most the poor, and highly generous unit benefits for those in the upper quintiles.

Regarding to health spending, Kyriacou *et al.* (2016) found that health spending has a strong impact on redistributive efficiency and Cubero and Hollar (2010) show that the distribution of public spending on health is progressive. In line with these authors, Bastagli *et al.* (2012) show that increases on public spending on health tend to decrease the inequality. Costa and Gartner (2017) show that if we invest more in health, we will have better reducing income inequality. So, in line with Bastagli *et al.* (2012) and Martínez-Vázquez *et al.* (2012), Costa and Gartner (2017) conclude that spending on health generate positive externalities and can contribute to the reduction of income inequality. They show that primary health care, hospital and outpatient care have made greater gain in reducing income inequality.

Now, regarding to education, Bastagli *et al.* (2012) show that increases on public spending on education tend to decrease the inequality. Ths is in line with Martínez-Vázquez *et al.* (2012) that also concluded that a higher average education level implies a more equal income distribution. Also, according to Woo *et al.* (2013), the education is significantly associated with lower inequality (a 1 percent increase in the average years of schooling is associated with about 0.04-0.12 percent reduction in inequality).

In contrast, there are authors that found that public spending on education may

increase the income inequality. Glomm and Ravikumar (2003) conclude that if the quality of schools for all individuals does not change, income inequality may even increase because there are other factors that contribute to the evolution of income inequality, such as the initial conditions of income distribution and public policy. Greater initial income inequality increases income inequality in the future: according to these authors, self-selection leads to inequality as there is a tendency for the richer to choose the best schools' districts (for example). According to these authors, individuals whose parents have low human capital allocate less time to learn. Also, according to Muinelo-Gallo and Roca-Sagales (2011) an increase in initial educational inequality increases income inequality.

On the other hand, Afonso *et al.* (2010) and Kyriacou *et al.* (2016) find that education spending does not significantly affects income distribution. They conclude that public spending in education affects income distribution but the most important factor is, though, education achievement. That is, a better education allows better monitoring and control over the effectiveness and efficiency of public expenditure, thus promoting a more equal income distribution (Afonso *et al.*, 2010).

To improve the income distribution equality, Rodrigues and Arnold (2015) found that the education system should provide more support to students with greater difficulties to decrease the rate of rejection and abandonment. Also, increasing the number of students per class would be a reasonable way to generate savings without affecting much of the learning progress. The expansion of vocational training courses and adult education, including in the context of active policies, can improve the ability of many homes to generate income and lead to a more equitable distribution of income. (Rodrigues and Arnold , 2015). For example, in Portugal, the fraction of household heads with less than upper secondary education is remarkably large (82.5%). The remaining groups, upper secondary and tertiary education, account for less than 10% of the sample each (Budria, 2007). That is, there are still many people who have a low degree of education. Michal (2018) show that the effect of education is related to the increased proportion of the population with tertiary education, that is, an increasing share of people with tertiary education have inequality-increasing effects.

To prove some theoretical mechanisms explained previously, will be presented an example. Goñi *et al.* (2011) compare two groups of different countries: Europe and Latin America. They concluded that in the European countries public transfers reduce the degree of inequality of income while in Latin America the transfers do not have a large effect on inequality because: i) in Latin America, the volume of transfers is much lower than in Europe,

and ii) a certain amount of segmentation leads to less progressive transfers in Latin America than in Europe. Lustig and Pereira (2016) also analyze inequality in income distribution in Latin America where countries are very different in regards to government-size and the structure of expenditure and they concluded that public spending on education and health have a more important role than other transfers in reducing inequality. Kyriacou *et al.* (2016) and Cubero and Hollar (2010)). Moreover, Lustig and Pereira (2016) found that there is a much larger portion of public expenditure dedicated to education and health spending compared to that on cash transfers. While in Brazil (that has the largest spending on health and education in Latin America) the size of the Government's budget is not a constraint on redistributive measures, in Ecuador, Mexico and Peru it would be important to create sufficient revenues to increase social spending.

The targeting of spending is also an important topic.

Following Chu *et al.* (2000), the government spending is considered to be well targeted if the poorest quintile's (bottom quintile) share of benefits from such spending is larger than the richest quintile (top quintile). This means that the poorest 20 percent benefit more than the richest 20 percent, in absolute terms. The government spending is considered to be progressive (regressive) if the benefits to the bottom quintile are larger (smaller) than the benefits to the top quintile, relative to their income or expenditure. So, with progressive (regressive) spending, benefits represent a smaller fraction of income or expenditure at a higher income or expenditure quintiles (Chu *et al.,* 2000). So, we can say that, if spending is well targeted, it will be progressive, but progressive spending may not be well targeted. And if spending is poorly targeted, it may be progressive or regressive.

According to Cubero and Hollar (2010), improving the targeting of social spending can result in a considerable reduction in inequality. For example, in the case of Nicaragua, the impact of an increase in social spending on the income of the poorest quintile would double if the current pattern of absolute regressivity of social spending was improved to at least a flat distribution.

According to Chu *et al.* (2000), education, health and transfer programs in developing countries show a progressive incidence, but many of them are not well targeted. All primary and secondary education programs, but only half of the tertiary education programs, assessed exhibited a progressive incidence. The targeting, however, was less effective. While all health programs were progressive, only half of them were well targeted (Chu *et al.*, 2000).

According to Bastagli *et al.* (2012) people with low income have lack of access to important services in terms of education and health. Aggregate education and health spending is regressive in many developing economies. However, increases in in-kind spending to finance the expansion of basic health services and education are likely to be progressively distributed more than existing spending (Bastagli *et al.*, 2012). In some OECD countries, cash transfers have a small size but are highly targeted to individuals who are worse off (OECD, 2012). Elsewhere, large cash transfers (that represent more than three quarters of the global impact on inequality) redistribute income mostly over the life cycle rather than through individuals (OECD, 2012).

But, even if spending on education is progressive, the distributional effects on different levels of education differ sharply. For example, in Central America public spending on primary education is in favour of the poor, that is, it is progressive. By contrast, spending on tertiary education is very regressive (Cubero and Hollar, 2010).

2.4. Fiscal Policy and income inequality: Some empirical evidence

The effectiveness of income distribution is thus, according to the literature, largely affected by taxes and public spending. Martínez-Vázquez *et al.* (2012) analyze the joint effect of taxes and public spending on income inequality and, although weak, their results point to a complementarity between the fiscal redistribution tools on the expenditure and revenue sides. Ramos and Roca-Sagales (2008) and Furceri *et al.* (2018) conclude that the effects of taxes on income inequality are much smaller than that of expenditures, being the effect of public transfers the one with stronger impact on income inequality.

The redistributive impact of taxes and public spending depends on the size, mix and the progressivity of each component and, hence, the impact of fiscal policy on income inequality may differ from country to country, depending on the design and composition: some countries have lower taxes and small welfare systems, but achieve the same redistributive impact as countries that have higher taxes and more costly welfare systems. Following, will be presented some evidence of the impact of fiscal policy on inequality in various countries and areas, both developed economies and developing economies.

In line with the authors mencioned before, Bastagli *et al.* (2012) concluded that, in developed economies, most of the redistributive impact of fiscal policies is achieved through

the government spending side, although taxes also have an important role in many countries. Goñi *et al.* (2011), through the analysis of 15 developed European Union economies,[2] have also concluded that public spending, particularly transfers, play a much more important role than taxes in decreasing inequality.

Wang and Caminada (2014) argue that in most OECD countries, the gap between richer and poorer has widened over the past decades. They found that the most important driver was the greater inequality in wages and salaries. Immervoll and Richardson (2011) conclude that in these countries benefits, like for example unemployment benefits and incapacity benefits, have a much stronger impact on inequality than social contributions or taxes do, what is in line with other authors (*e.g.*, Bastagli *et al.* (2012). Despite the increasing size of the direct taxes, the impact that benefits have on inequality is stronger than that of social contributions and taxes because the benefits offer a support for people who have a lower income. So, it is expected that changes on benefits have a more significant impact in global distribution and the degree of inequality. "*Several OECD countries have recently faced severe budgetary pressures, particularly on governments' social retirement and health care finance systems. Public policy has considerable influence on the distribution of income in society*" (Suoniemi *et al.*, 2008, p. 8).

However, the progressivity and the size effect of taxes and transfers are also relevant variables for developed countries. For instance, in Australia taxes and transfers are smaller but more progressive than the OECD average, while in Germany taxes and transfers are larger but less progressive than the OECD average (Joumard *et al.*, 2012). In Finland, Suoniemi *et al.* (2008) conclude that, the increase in income inequality is due to the decline in income progressivity and to the increasing shares of income from capital. The latter is the main source of the increase in income inequality.

Now, regarding to developing economies, Cubero and Hollar (2010) found that, similarly to developed economies, social spending has a more redistributive impact than taxes (in line with Ramos and Roca-Sagales (2008) and Furceri *et al.* (2018)). They found that in Central America, available data suggest that the net redistributive effect of fiscal policy is modestly progressive. While taxation has a small regressive effect, social spending has a larger progressive impact, thus yielding a progressive net effect.

However, Krstic (2016) found that in Serbia taxes and benefits policies reduced income inequality, but their impact is low compared to developed economies. This relatively

[2] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, Spain, Sweden and United Kingdom.

modest redistributive role of direct taxes and social transfers is due to the low coverage of social transfers and the very low progressivity of Serbian personal tax system (Krstić, 2016). Similar conclusions were presented by Goñi *et al.* (2011) as regards some Latin American countries.[3] The authors found that the redistributive impact of taxation and transfers is larger in developed Europe Union countries than in Latin America. The main reason, according to Goñi *et al.* (2011), is that Latin America makes a "bad" fiscal redistribution due to the low volume of resources collected and transferred, to the fact that collection is regressive and transfers are barely directed. Lustig and Pereira (2016) also emphasized this "bad" fiscal redistribution in Latin America, manly because social transfers go, ultimately, to the richest, being most regressive.

Bastagli *et al.* (2012) also show that the impact of fiscal policies in developing economies is restricted to low overall levels of both taxes and transfers. Chu *et al.* (2000) show that developing countries do not have adequate redistributive programs to achieve a post-tax, post-transfer income equality comparable to that in industrial countries. Michal (2018), found that, during the Great Recession of 2009-2010, the Gini coefficient has increased in countries like Bulgaria and Hungary. According to the author, this worsening of the income distribution in Hungary and in Bulgaria was related to policy changes that made the tax and benefit system less redistributive.

In contrast with most of the authors, Odusola (2017) found that, in China, the taxes reduce the income inequality while government spending increase income inequality. Also, Cevik and Correa-Caro (2015) showed that, in China, government spending and taxation have opposing effects on income inequality. While government spending appears to have a worsening impact, taxation improves income distribution. Also focusing on an Asiatic country, Korea, Sung and Park (2011), found that direct taxes, in-kind benefits and social security contributions reduced income inequality by 13.8 percent in 2007. Yet, they found that indirect taxes, as consumption taxes, have a small or even positive effect on inequality.

These differences in a similar group of countries were also observed in Latin America. While, according to Lustig and Pereira (2016), Brazil and Uruguay have decreased income inequality essentially through direct taxes and transfers, in Ecuador, indirect taxes have had a large effect on promoting income equality. They also found that in Costa Rica, Brazil and Ecuador, public spending on health and education were relevant to reduce income inequality.

[3] Argentina, Brazil, Chile, Colombia, Mexico and Peru.

According to Lustig and Pereira (2016), all these countries vary in terms of impact of redistributive tax policies and this variation is not always correlated with size, "*perhaps the most interesting finding is that equity may matter more than size*." (Lustig and Pereira, 2016, p. 133). So we can conclude that even within similar group of countries, different countries have different types of spending and revenues and fiscal policies have different impacts on inequality.

Summing-up, in Table 1 and Table 2 are presented the main conclusions. We can conclude that in developed economies, fiscal policies have a stronger impact, and the spending side instruments play a much more important rule in reducing the income inequality. But, regarding to developing economies, evidence is mixed, being the conclusions different across countries (as we can see on the Table 1 presented below), and the fiscal policies in these countries tend to be less redistributive.

Table 1: Revenue Side vs. Spending Side - Developing Economies

Developing Economies	**Revenue Side**	**Spending Side**	**Author(s)**
Brazil (2009-2011)	Direct taxes decrease income inequality	Spending on health and education decrease the income inequality	Lustig and Pereira (2016)
Ecuador (2009-2011)	Indirect taxes decrease income inequality	Spending on health and education decrease the income inequality	Lustig and Pereira (2016)
Costa Rica (2009-2011)	-	Spending on health and education decrease the income inequality	Lustig and Pereira (2016)
Uruguay (2009-2011)	Direct taxes decrease income inequality	Government spending decrease income inequality	Lustig and Pereira (2016)
China (1990-2014)	Taxes decrease the income inequality	Government spending increase income inequality	Odusola (2017) Cevik and Correa-Caro (2015)
Serbia (2013)	Direct taxes decrease income inequality	Government spending decrease income inequality	Krstic (2016)
Korea (2007)	Direct taxes and SSC decrease income inequality	-	Sung and Park (2011)

Central America (2004-2008)	Taxes increase income inequality	Government spending decrease income inequality	Goñi *et al.* (2011)

Table 2: Revenue Side vs. Spending Side - Developed Economies

Developing Economies	**Revenue Side**	**Spending Side**	**Author(s)**
15 European Union economies (2004-2008)	Taxes decrease income inequality	Government spending decrease income inequality	Goñi *et al.* (2011)
OECD countries (1979-2005)	Taxes decrease income inequality	Government spending decrease income inequality	Bastagli *et al.* (2012)
Australia (2000-2009)	Taxes decrease income inequality	Government spending decrease income inequality	(Joumard *et al.* (2012).
Germany (2000-2009)	Taxes decrease income inequality	Government spending decrease income inequality	(Joumard *et al.* (2012).

3. Empirical analysis

3.1. Methodology

With the purpose of analyzing the impact of taxes and public expenditure on income inequality, we will use a vector autoregressive model (VAR). The VAR model is commonly used, among others, to assess fiscal multipliers, *i.e.*, the impact of fiscal shocks on real income, which we propose to extend with an additional variable capturing income inequality.

This method is used in the modeling of time prediction systems that are interrelated, thus providing an important analysis of the impact of random shocks on the variables included in the system. This model is also appropriate to estimate medium and long term impacts of fiscal policies because it allows for dynamic feedback between variables. In addition, VAR models are proper when variables of interest are endogenous, as is that case with tax revenue, public expenditure, output and inequality that are interconnected. So, we will follow the methodology used by Ramos and Roca-Sagales (2008), but we will use data from two groups of countries in the EMU: i) Portugal, Ireland, Spain, Greece and Spain, the PIIGS countries and ii) France, Netherlands, Germany, Austria and Finland, grouped as the Core countries, for a period of available data of 20 years (1996-2016). We aim at analyzing the impact of the different components of public revenue and expenditure on income inequality (and on output), whereas available related literature either treats public spending and taxes as a whole or relies on economic, and not functional, disaggregation of public expenditures. However, the components of the expenditure and revenue side may have different effects on the output and on the income inequality. For example, direct and indirect taxes influence inequality differently, since they differ in terms of the level of taxation and progressiveness. Thus, unlike most studies done, we will consider the various components of the revenue and expenditure side to separate effects, which may operate in opposite directions. Moreover, different types of expenditure, namely disaggregated by function are expected to have different impacts on inequality, namely education and social spending when compared to general government expenditures.

The benchmark model includes GDP, government spending and revenue and income inequality (measured by the Gini disposable income coefficient). This model is extended to also include fiscal variables in disaggregated form: government spending is split into social protection, general public services, education, health, economic affairs and a residual category (other), and government revenues include direct taxes, indirect taxes and social

security contributions. The inclusion of a measure of inequality in the VAR specification allows a joint analysis of the macroeconomic and distributional effects of fiscal policy.

3.1.1. VAR methodology: theoretical elements

The vector autoregressive (VAR) is commonly used to estimate systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables.

$$\boldsymbol{X_{t,i} = \sum_{i=1}^{k} M_i X_{t-i} + e_t} \qquad \textbf{(3.1.1.1)}$$

where

- X is a vector of size n which includes the endogenous variables of interest (government spending, government revenue, Gini coefficient and GDP),
- M_i is a nxn matrix of coefficients to be estimated,
- k represents the number of lags introduced in the model,
- Et is a nx1 white noise innovation process, with $E(e_t)=0$, $E(e_t, e_t')=\sum_e$, $E(e_t, e_s')=0$ for $t \neq s$,
- t denotes the time trend,
- i represents the country.

According to Hebous (2010), the inclusion of the vector of residuals allows us to capture three distinct effects: the responses of discretionary fiscal policy, automatic stabilizers and random discretionary fiscal policy responses. The latter is what the structural fiscal shock is meant to capture.

The structural VAR model takes the following form:

$$\boldsymbol{A_0 X_t = \sum_{i=1}^{k} A_i X_{t-i} + B v_t} \qquad \textbf{(3.1.1.2)}$$

where

- A_0 represents a matrix that describes the contemporaneous relationships among the variables in the vector X_t,
- B represents a matrix that describes the relation between the reduced form residuals e_t and the structural form residuals v_t. Being that:

$$\boldsymbol{v_t = B^{-1} A_0 e_t} \qquad \textbf{(3.1.1.3)}$$

The dynamics of the variables after a one unit increase in the current value of the structural residual in the fiscal equation holding all other variables fixed – structural fiscal shock - can be summarized in the impulse responses of the variables included in the system.

The main challenge when using a VAR methodology to estimate and predict how fiscal policy affects economic activity and/or inequality goes through the identification of the structural shocks, isolating all the factors that can influence the mechanism of transmission to the economic activity.

Following the work done by Hebous (2010), there are four approaches in the literature to solve this problem.

The first approach to solve this issue corresponds to the so-called recursive formulation (Cholesky decomposition). In this method, the first variable included in the system only responds to exogenous shocks on itself, implying that it does not respond to contemporary demand shocks. The second variable responds to shocks of the first variable and to their own, while the third variable responds to shocks of the first two variables and their own shock and so on, depending on whether to expand the number of variables in the system. In this case, we have four variables, but the procedure is the same. The order of the variables is crucial, since it will be this order that will establish the causal relationship between the different variables, although there is no specific rule about such ordering.

The matrix can reproduce the ordering referred to as follows, *e.g.*,

$$\begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \boldsymbol{a_{21}} & \mathbf{1} & \mathbf{0} & \mathbf{0} \\ \boldsymbol{a_{31}} & \boldsymbol{a_{32}} & \mathbf{1} & \mathbf{0} \\ \boldsymbol{a_{41}} & \boldsymbol{a_{42}} & \boldsymbol{a_{43}} & \mathbf{1} \end{bmatrix} \begin{bmatrix} \boldsymbol{e^{spending}} \\ \boldsymbol{e^{output}} \\ \boldsymbol{e^{inequality}} \\ \boldsymbol{e^{taxes}} \end{bmatrix} = \begin{bmatrix} \mathbf{1} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{1} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{1} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{1} \end{bmatrix} \begin{bmatrix} \boldsymbol{v^{spending}} \\ \boldsymbol{v^{output}} \\ \boldsymbol{v^{inequality}} \\ \boldsymbol{v^{taxes}} \end{bmatrix} \qquad \textbf{(3.1.1.4)}$$

The second approach is known as the approach of structural identification proposed by Blanchard and Perotti (2002), in which it is argued that it is possible to identify some elements of the matrix $\mathrm{B}^{-1}\mathrm{A}_0$ through the study of tax and expenditure elasticities in relation to the product. These elasticities correspond to certain elements in the matrix A_0. In this case, after being estimated the elasticities, the values are included in the VAR model.

The third approach is called as sign restriction. In this approach it is no longer necessary to enforce the absence of contemporary effects on some variables, what was happening in the approaches explained previously, but rather required the establishment of restrictions on the signal of impulse responses of the fiscal variables. Mountford and Uhlig (2009) divided possible shocks between fiscal and non-fiscal, in which the last set are the

business cycle shocks and monetary policy, while in the first are the shocks on the expense and public revenue. The signs were only applied to the second set of shocks, having been established that the business cycle has a positive impact on public spending, product, consumption and investment by non-residents, not being applied to any restriction on sign of public expenditure.

Finally, the fourth approach is the inclusion of dummy variables in the model, and the response to the shock is measured through the reaction of the dummy variables. The new reduced form VAR is:

$$\boldsymbol{X_t = \sum_{i=1}^{k} M_i X_{t-i} + \sum_{j=0}^{l} D_j d_{t-j} + e_t} \qquad \textbf{(3.1.1.5)}$$

where *j* is the lag order associated with the dummy *d* and *D* is the associated matrix of coefficients. The disadvantage of this approach is that other fiscal shocks of different propositions might have occurred parallel to the identified episodes (Hebous, 2010).

To the identification of the fiscal shock we follow the Cholesky decomposition (see, for example, Ramos and Roca-Sagales, 2008).

So, in our benchmark model, and closely following the methodology in Ramos and Roca-Sagales (2008), we assume that: (i) public expenditure does not react contemporaneously to shocks to the other system variables, that is, public spending is exogenous on impact - for example, on impact, output responds to changes in public spending but public spending does not respond to changes in output; (ii) the output is contemporaneously affected by shocks in public spending, but does not react contemporaneously to shocks in inequality or taxation - that is, on impact, taxation and inequality respond to changes in output but output does not respond to changes in tax revenues and inequality; (iii) inequality is contemporaneously affected by shocks in public spending and in output, but does not react contemporaneously to shocks in taxation; (iv) tax revenue are affected by all system variables, that is, changes in output, public expenditure and inequality affect the taxation.

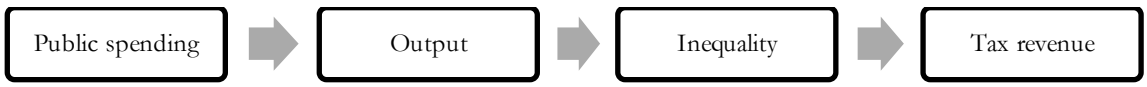
This set of assumptions about the contemporary relationship between the variables is assumed to dominate the effects of demand, which justifies the contemporary effect of public expenditure in the output. However, the reverse is not plausible since most of the non-government spending is related to the business cycle (Ramos and Roca-Sagales, 2008). Due to the lags of implementation caused by budgetary process, public spending decisions are taken before the public sector obtains the information about the actual performance of the economy. The changes in public spending can have an immediate impact on the income

of individuals and on the distribution of income. Also, consumption and investment decisions of agents are not immediate, being dependent on the policies pursued by the government.

According to Ramos and Roca-Sagalés (2008), in the very short term, changes in the tax base are the only likely source of changes in the tax revenue, and changes in output or distributional changes change the tax base. Therefore, we assume that tax revenue reacts contemporaneously to inequality and output shocks. For instance, changes in the unemployment rate due to changes in income affects inequality and that affects the tax base and even the medium tax rate. Moreover, a discretionary change in tax rates (namely in direct taxes) only impact on income, and thus on inequality in the following period.

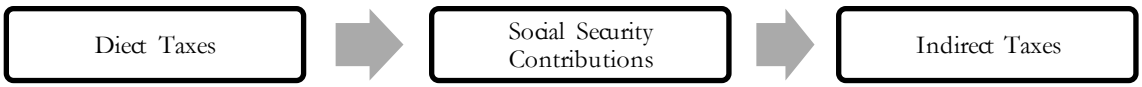
Summing up, the ordering that results from the above-mentioned assumptions, for the benchmark model specification is:

Figure 1: Cholesky ordering in the benchmark model



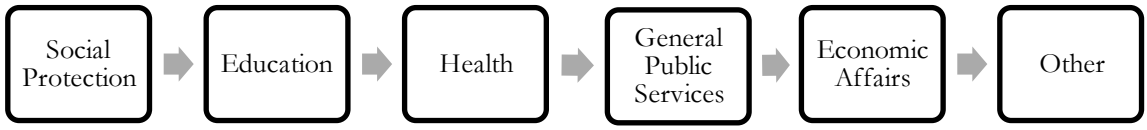
In what regards revenue side, we assume that direct taxes revenue does affect contemporaneously indirect tax revenue, but does not react contemporaneously to shocks to indirect tax revenue. That is, shocks to direct taxes alters disposable income, which in turn may lead to consumption changes, and thus changes in the revenue from indirect taxation. Hence the ordering of the tax variables is: direct taxes, social security contributions and indirect taxes. This is in line with Ramos and Roca-Sagalés (2008).

Figure 2: Cholesky ordering of revenue-side variables



In regards to expenditure side, we assume that the ordering is: social protection, education, health, general public services, economic affairs and other government spending. To the best of our knowledge, the literature is absent on the ordering of functional segments of public expenditure and the results are rather robust irrespectively of the ordering.

Figure 3: Cholesky ordering of expenditure-side variables



Since data is annual, a time lag of one period was chosen to model the VAR.

3.2. Data and variables

This section provides a summary description of the data used in the empirical analysis.

We use annual data for 1995-2016. The macroeconomic series were obtained from Eurostat[4] and from OECD database[5] and expressed in real terms, in millions of euros.

In addition, fiscal variables follow a functional classification and are obtained from the OECD database.[6] On the expenditure side, we consider spending on social protection, general public services, education, health, economic affairs and other. The latter includes spending on defense, public order and safety, environment protection, housing and community amenities and spending on recreation, culture and religion. On the revenue side, we distinguish between direct tax revenue (taxes on income, profits and capital; taxes on playroll and workforce; and recurrent taxes on immovable), indirect tax revenue (recurrent taxes on net wealth; estate, inheritance and gift taxes; taxes on financial and capital; non-recurrent taxes on property; other recurrent taxes on property; taxes on goods and services; and other taxes) and social security contributions (SSC). In addition to the fiscal variables, traditionally defined as endogenous, we will also use the Gini income coefficient, obtained from Eurostat[7], together with GDP, obtained from the OECD database.

We aim at calculating the income and the inequality multipliers in the short and the long term, providing assessment of the impact on GDP and on Gini coefficient from a unit increase in public spending, for example.

For the sample horizon (1995-2016), average government spending represented about 45% of GDP in PIIGS and 50% of GDP in the core countries. In the PIIGS (core), 16% (21%) of GDP was devoted to social protection spending, 8% (7%) of GDP to spending on

4 http://ec.europa.eu/eurostat/data/database , accessed in april 2018.
5 http://stats.oecd.org, accessed in april 2018.
6 http://stats.oecd.org, accessed in april 2018.
7 http://ec.europa.eu/eurostat/data/database, accessed in april 2018.

general public services, 4% (5%) of GDP was education spending, 6% (7%) of GDP corresponded to health spending, 5% (5%) of GDP was to spending in economic affairs and 6% (6%) of GDP corresponded to other government spending. In regards to government revenues, these represented 37% of GDP in PIIGS and 39% of GDP in core countries. In PIIGS (core), 12% (12%) of GDP represented revenues from direct taxes, 13% (14%) of GDP represented revenue from indirect taxes and 11% (13%) of GDP were social security contributions.

All variables are presented in constant prices. We converted all fiscal variables in constant prices through using the GDP deflator indexed 100 in 2010.

The designations presented in Table 1, below, correspond to the final name of the variables in the model estimated in *Eviews10*, after making the first differences of the variables in logs in order to make them stationary.

Table 3: Variable labeling

Social Protection	G_SOCIAL_PROTECTION
General Public Services	G_GENERAL
Education	G_EDUCATION
Health	G_HEALTH
Economic Affairs	G_ECO_AFFAIRS
Others Government Spending	G_OTHERS
Output	G_GDP
Gini Coefficient	G_GINI
Direct Taxes	G_TDIR
Indirect Taxes	G_TIND
Social Security Contributions	G_SSC

Tables 1A and 2A in annex, present the average value of each variable. Corresponding mean, maximum and minimum values are presented as well. For each variable, there are 110 observations for the analysis.

Through the analysis of the Gini descriptive statistics, and comparing PIIGS with core countries, we can conclude that the first exhibit higher income inequality: PIIGS exhibit an

average Gini of 0.33 while the average for the core countries is of 0.27. Can different use of fiscal policy instruments be a source for inequality differences in the two groups of countries?

In terms of the empirical implementation, we start by determining the order of integration of the variables. Unit root tests are performed to check whether a time series variable is non-stationary. A series is said to be stationary if the mean and autocovariances of the series do not depend on time. There are different types of unit root tests that we will use: the Augmented Dickey-Fuller (ADF) test, the Phillips-Perron (PP) test and Im, Pesaran and Shin W-stat. They are appropriate for panel data.

So, unit root assessment is based on three different tests. Results are presented in Table 2, below for variables in first difference. In the unit root tests, we included in test equation only the individual intercept and no trend. As we can see on the table below, most of the variables are stationary in first differences of log-levels.

Table 4: Unit Root Tests with no intercept and no trend

	PIIGS			**Core countries**		
Variable	**Im, Pesaran and Shin W-stat**	**ADF – Fisher Chi-square**	**PP – Fisher Chi square**	**Im, Pesaran and Shin W-stat**	**ADF – Fisher Chi-square**	**PP – Fisher Chi square**
Social Protection	0.0188	0.0353	0.000	0.0000	0.0000	0.0000
Education	0.0611	0.1173	0.0017	0.0080	0.0131	0.0007
Health	0.3591	0.5658	0.1001	0.0388	0.0454	0.0000
General Public Services	0.0091	0.0169	0.0000	0.0000	0.0000	0.0000
Economic Affairs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Others Spending	0.0089	0.0174	0.0001	0.0000	0.0000	0.0000
Direct Taxes	0.0004	0.0012	0.0000	0.0000	0.0001	0.0000
Indirect Taxes	0.0026	0.0069	0.0000	0.0033	0.0034	0.0019
Social Security Contributions	0.0013	0.0014	0.0001	0.0000	0.0001	0.0000
Gini	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
GDP	0.0597	0.1004	0.0536	0.0000	0.0001	0.0000

Through the analysis of the table presented above, we can see that, in PIIGS, the probability of the government spending on health be non-stationary is high. So, we did the unit root test but on the equation we did not include the intercept and the results obtained are presented in Table 3.

Table 5: Unit Root Test of Health in PIIGS with trend and no intercept

Variable	Levin, Lin & Chu t*	ADF – Fisher Chi-square	PP – Fisher Chi square
Health	0.0002	0.0134	0.0013

Results in Table 3 show that the probability of the health spending being non-stationary is low. So, in order to estimate the VAR model, we consider the first differences of log-levels to all variables. Note that we try to estimate the VAR model using the second differences of logs of spending on health but the results remained the same, so we use the first the differences of logs because of the interpretation.

We consider the effects on the growth rate of output and on the growth rate of income inequality of a one-off one percentage point shock in the growth rate of the fiscal policy variable.

4. Analysis of the results

In this section, we present and analyze the results obtained in the estimation of the VAR models. Whenever possible, a comparison will be established between our results and those obtained in the revised literature.

First, we will analyze the impulse responses of the Gini coefficient and the GDP to alternative fiscal shocks, as well as, the link between output and income inequality, and then, we will compute the related multipliers.

Moreover, we will assess the impact of different types of public expenditure and tax revenue on GDP and on income inequality, in the PIIGS countries, comparing with the core EMU countries.

4.1. Impulse response functions

Our estimates of the effects of fiscal policies are based on the impulse response functions, which result from the VAR estimation. A shock to the *i*-th variable not only directly affects the *i*-th variable but is also transmitted to all the other endogenous variables through the dynamic structure of the VAR. An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. So, the impulse response functions reveal the mechanisms through which a given shock spreads over time.

If the innovations ϵ_t are contemporaneously uncorrelated, interpretation of the impulse response is straightforward. The *i*-th innovation $\epsilon_{i,t}$ is simply a shock to the *i*-th endogenous variable $y_{i,t}$. Innovations are, however, usually correlated, and may be viewed as having a common component which cannot be associated with a specific variable. In order to interpret the impulses, we will apply a transformation *P* to the innovations so that they become uncorrelated:

$$\boldsymbol{u_t = P\epsilon_t \sim (0, D)} \qquad \textbf{(4.1.1)}$$

where D is a diagonal covariance matrix.

The impulse and cumulative impulse response functions are important for measuring the impact of fiscal policies in both the short term and the medium and long term.

We will start our analysis by running impulse response functions of Gini coefficient and GDP to shocks in overall government expenditure and revenue and, in particular, to shocks in the following variables: social protection spending, education spending, health spending,

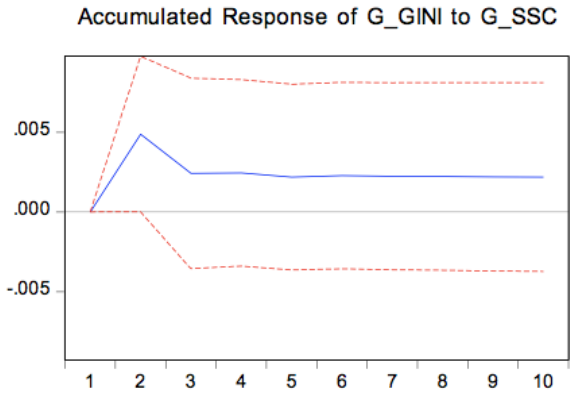
spending on economic affairs, other public spending, indirect taxes, direct taxes and social security contributions.

We will firstly test the response of Gini in subsection 4.1.1 and, secondly, we will test the response of GDP in 4.1.2. In subsection 4.1.3 we will analyze the link between output and income inequality.

4.1.1. Impulse responses of income inequality to fiscal shocks

In the Figures to follow, we plot the cumulative impulse responses of the growth in the Gini coefficient to selected fiscal shocks to which responses were, at least, point significant. Time horizon extends to 10 periods (10 years ahead).

Figure 4: Cumulative response function of Gini to SSC, PIIGS



Starting with the group of PIIGS, and in regards to revenue shocks, only the response to Social Security Contributions is statistically significant in the short run and its effect on income inequality is positive, that is, it increases the Gini coefficient, increasing income inequality. Inequality increases continuously with increasing of SSC. This is in line with Martínez-Vázquez *et al.* (2012), that show that the SSC can be regressive, representing most of pretax income for low-income workers. That is, increases in SSC tend to be regressive in PIIGS, increasing income inequality.

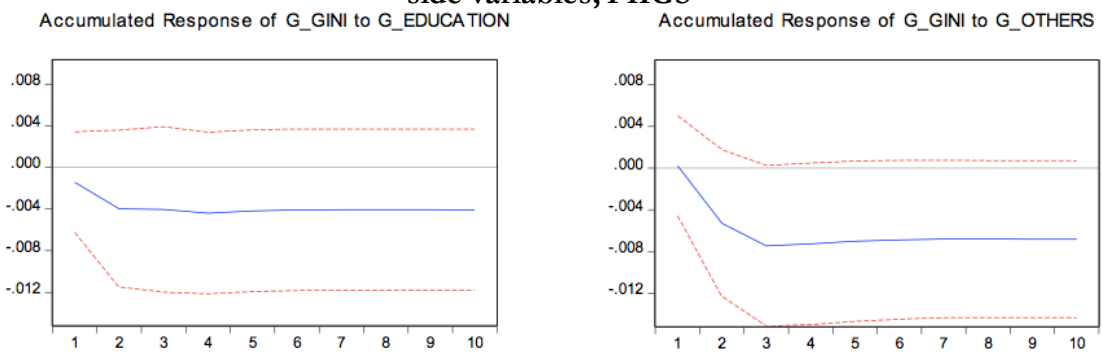
SSC may represent profit deviations towards low-income workers (an increase in firm's costs may lead to higher unemployment) or a change in after-tax labor income for the workers, and it is usually regressive in most cases; so, an increase in social security contributions reduces disposable income of households and that may contribute to increase income inequality. Also in line with our non-significant results for the medium run on the

growth rate of the Gini coefficient, according to Paulus *et al.*, (2009), social security contributions have the smallest equalizing effect, given that it is not their main purpose.

On the other hand, not in line with our results, Sung and Park (2011) show that an increase in SSC reduces income inequality.

In what regards the Core countries, and on revenue side, none of the fiscal variables appears to be statistically significant to income inequality.

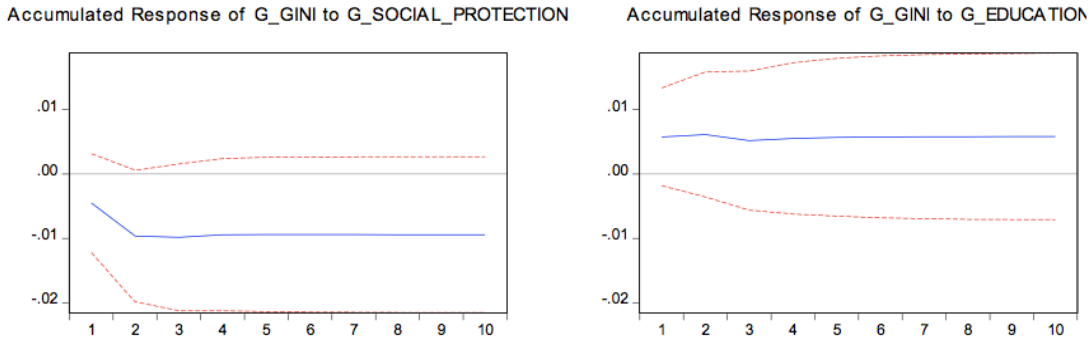
Figure 5: Cumulative response function of Gini to selected government spending side variables, PIIGS



Looking at the expenditure side, in PIIGS, and in spite of education spending exhibits a slightly non-significant effect on income inequality, it tends to reduce income inequality. This is in line with most of the literature (*e.g.* Martínez-Vázquez *et al.* (2012) and Bastagli *et al.* (2012)).

Also, as we can see from Figure 5, other government spending is statistically significant and exhibits a negative effect on income inequality, reducing income inequality. This can be justified because "Other" government spending includes, among others, housing spending. So, by increasing disposable income of the poorest families, this is expected to make income inequality to decrease. This conclusions are in line with Martínez-Vázquez *et al.* (2012) and Kyriacou *et al.* (2015).

Figure 6: Cumulative response function of Gini to selected government spending side variables, Core countries



In Core countries, the spending on social protection has a negative impact on income inequality: an increase on the spending on social protection decreases the Gini coefficient, decreasing income inequality (one period decrease in the Gini growth rate, and permanently decrease income inequality). This is in line with other authors (*e.g.* Martínez-Vázquez *et al.* (2012)). Niedzwiedz *et al.* (2016) also found that spending on social protection decreases the income inequality. They also found that decisions on the level of investment in social protection may have implications for the disadvantages groups. That is, the countries that invest more in specific types of social protection can be more efficient, reducing inequalities.

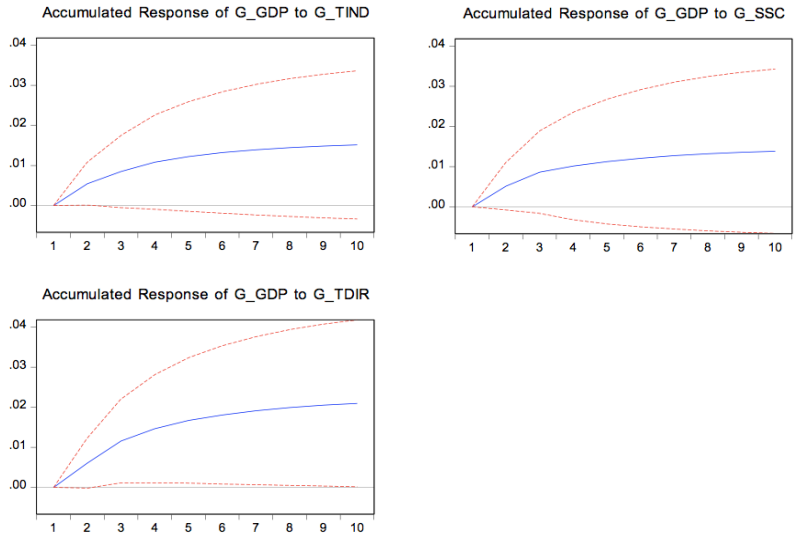
Regarding to social protection, we can say that this can intensify the long-term economic growth with reducing unacceptable levels of inequality and possible negative impacts of wrong choices of policies on the lack of social cohesion or on public disruption. The poor people are more frequently the most vulnerable to the risks of all kinds (lack of food for example). A high level of inequality, allied with the absence of adequate social protection mechanisms, threatens social cohesion and political stability. The social and economic role of social protection began to be seen more positively and has been recognized as a means of risk-sharing in face of economic headwinds, and as a collective tool to mitigate the effects of the growing social inequality. So it is an important topic to take into account.

Still about government spending, and unlike the case of PIIGS countries, education spending in core countries tends to exhibit a positive impact on the Gini coefficient, that is increasing education spending tends to increase income inequality, although not statistically significant. This is in line with Cubero and Hollar (2010), and with Lustig (2017) and it may reflect the preverse evidence of a decrease in education spending as higher-income students increased demand towards private education system.

4.1.2. Impulse responses of output to fiscal shocks

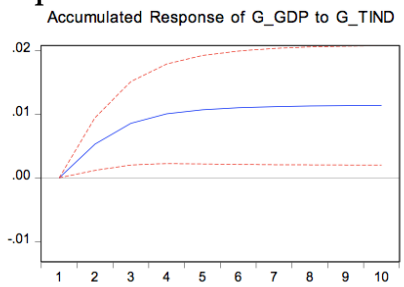
Figures in this subsection show the cumulative impulse response functions of the growth in GDP to the alternative shocks in fiscal variables. As in the case of income inequality reactions, we first look at the revenue side and, then, at the expenditure side. Impulse responses have a 10-year horizon.

Figure 7: Cumulative response functions of GDP to selected government revenue side variables, PIIGS



In regards to revenue side and starting with the PIIGS, we can see that, direct taxes have a positive effect on GDP, contrary to most of the literature, *e.g.*, Muinelo-Gallo and Roca-Sagalés (2013) and Goñi *et al.* (2011) and Martinez-Vazquez and Vulovic (2014), argues and that concludes that direct taxes have a negative and significant effect on growth, that is, it can produce significant reductions in the growth of GDP. Our results also show that indirect taxes and SSC also have a positive impact on growth. These conclusion about the PIIGS, regarding to tax revenue are not in line with Afonso and Sousa (2009), that show that a positive shock on the side of the Government revenue have a negative impact on GDP. So, these results are not in line with most of the literature, although, regarding to indirect taxes there is some evidence *(e.g.* Scarlett (2011) and Ilaboya (2012)).

Figure 8: Cumulative response function of GDP to indirect taxes, Core countries

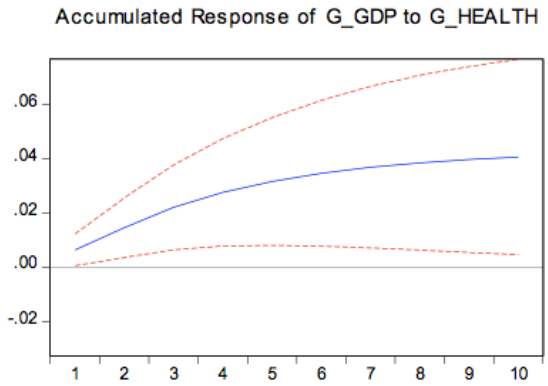


Considering the group of the core countries, indirect taxes also have a positive significant effect on GDP. This is contrary to what Muinelo-Gallo and Roca-Sagalés (2013) argue. They show that indirect taxes have no significant impact on growth. Also, Mountford and Uhlig (2009) argues that the GDP fall in response to an increase in revenue, that is, an anticipated increase of revenue reduces the output and consumption. Additionally, Omran (2017) shows that the response of the variables to a tax shock, GDP responds positively to a one standard deviation shock from tax revenue until the second year, however, it becomes constant after that. So, we can conclude that tax revenue shock has a positive but weak impact on output.

But there are studies where similar conclusions to our work apply. The study done by Scarlett (2011) indicates that increasing the revenue from indirect taxes may conduce to economic growth in the long-run. Also, in this line, Ilaboya (2012) show that some indirect taxes have a positive impact on economic growth. And Ibadin and Oladipupo (2015) show that Value Added Taxes (VAT) and Petroleum Profit Tax (PPT) have a positive and significant relationship with economic growth.

We also could not find evidence on direct taxes and SSC to statistically affect growth.

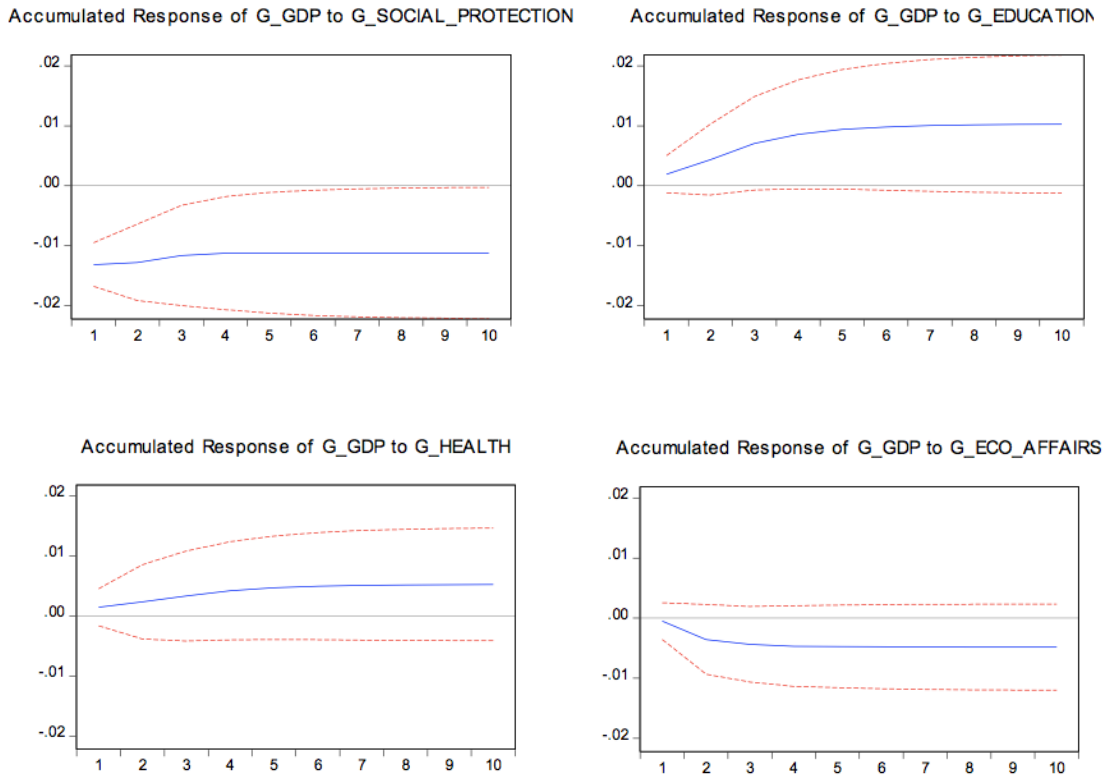
Figure 9: Cumulative impulse response function of GDP to health spending, PIIGS



Regarding now the expenditure side, in PIIGS, we conclude that spending on health is, among expenditure-side instruments, the only instrument yielding significant and positive effect on GDP: an increase in the spending on health will increase the GDP, contributing to economic growth. Kurt (2015) also found that the direct impact of government spending on health on economic growth is positive and significant.

Economic growth requires public spending (namely through spending on health and education). So, this result is in line with expected in the literature of economic growth (*e.g.* Sylwester (2000)).

Figure 10: Cumulative impulse response function of GDP to selected government spending side, Core countries



In Core countries, spending on health also has a positive effect on GDP, although barely significant. Although, spending on social protection has a negative effect, decreasing the output, that is in line with Omran (2017). This proves that social protection schemes often involve an equity-efficiency trade-off: they may reduce inequality (*cfr.* Figure 6) but at a cost of lower efficiency. Regarding to spending on economic affairs, we can conclude that these have a negative impact, although barely significant, on economic growth.

Regarding to public spending on education, our results show that these have a positive effect on output, that is, the increase on spending on education will generate more output in the core countries. According to Kabuga and Hussaini (2015), the long run coefficient of government spending on education are statistically significant and are positively related to growth. Mekdad et al. (2014) also showed that public spending on education has a strong positive relation with growth. But, according to Sylwester (2000), although public education expenditures are positively associated with future economic growth, the contemporaneous effect upon growth is negative, that is not in line with our results. The author shows that countries with a higher level of income inequality also have larger subsequent expenses for public education in relation to GDP. These expenses in education have a negative impact on

the contemporary growth, but previous expenses have a positive impact. The increase in the level of human capital may not have an immediate and positive impact on growth.

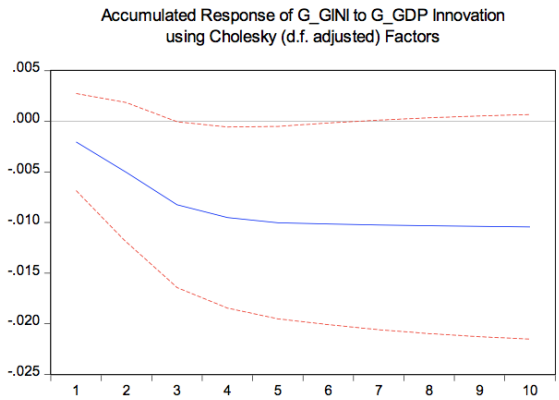
Summing-up, the most relevant mechanisms are different for these groups of countries, For both groups of countries, there is an important contribution of health spending on GDP, and this has a more significant impact in PIIGS.

Our results regarding to government revenue side show non-Keynesian effects. This results are not in line with most of the literature, for example, with Ramos and Roca-Sagales (2008), that conclude that the output effects of fiscal policy are consistent with the Keynesian paradigm for taxes, that is, tax cuts increase output.

4.1.3. Link between output and income inequality

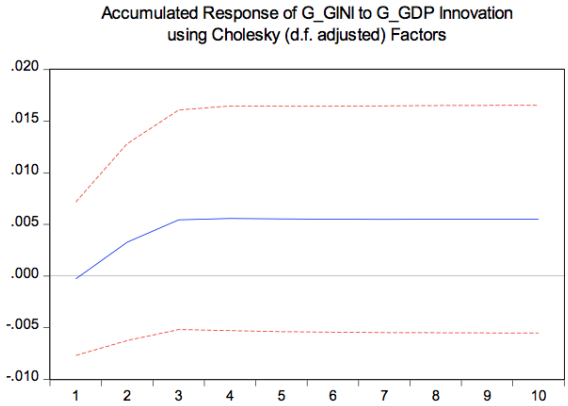
As a byproduct of our analysis, consider now the relationship between the output and income inequality. For this, we will analyze the accumulated impulse response functions of GDP to Gini, as well as the reverse, in PIIGS and in the group of the core countries.

Figure 11: Cumulative impulse response function of Gini to GDP, PIIGS



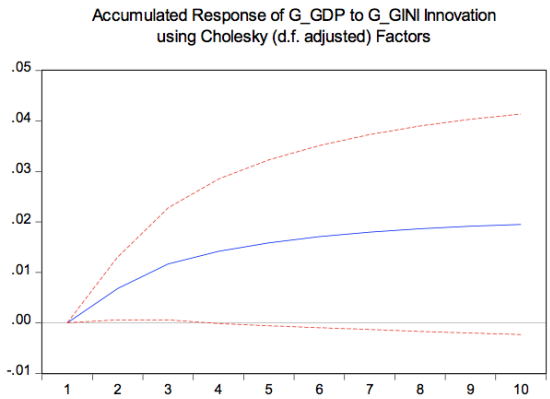
Considering the impact of GDP on income inequality, we can see from Figure 11 that this effect is negative in the group of the PIIGS countries. That is, an increase on GDP will generate a decrease on the Gini coefficient. In other words, there is an inverse link between the growth and inequality. This is in line with Cevik and Correa-Caro (2015) that found the existence of an inverted relationship between income inequality and economic growth.

Figure 12: Cumulative impulse response function of Gini to GDP, Core countries



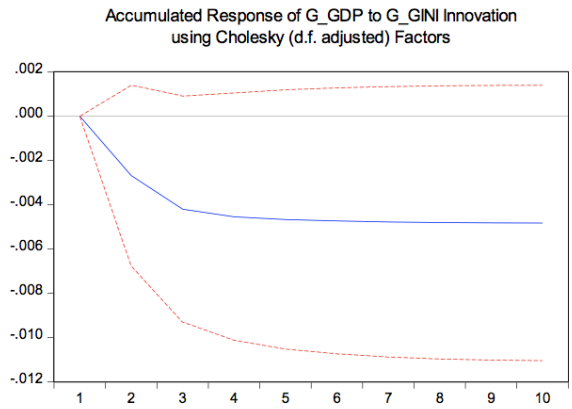
Regarding core countries, we can conclude that growth does not statistically affect inequality, unlike the case of PIIGS.

Figure 13: Cumulative impulse response function of GDP to Gini, PIIGS



Now, considering the impact of Gini coefficient on output, in PIIGS, we conclude that the effect is positive, that is, an increase in Gini will increase the output. This is in line with Muinelo-Gallo and Roca-Sagalés, (2013) who show that income inequality has a positive and significant impact on economic growth.

Figure 14: Cumulative impulse response function of GDP to Gini, Core countries



Unlike the case of PIIGS and contrary to what Muinelo-Gallo and Roca-Sagalés (2013) argues, in Core countries, income inequality has a negative effect on output, that is, an inverse link between these two variables arises, although barely significant.

Also, Cingano (2014) shows that inequality has a negative impact on economic growth. For example, lowering inequality by 1 Gini point would translate in an increase in cumulative growth of 0.8 percentage points in the following 5 years (or 0.15 points per year).

Brueckner and Lederman (2017) showed that in low income countries, the income inequality is positively correlated with transitional GDP per capita growth. On the other hand, in high income countries, there are a negative correlation between the income inequality and GDP. These results are in line with those we got: a positive relation between inequality and output in relatively lower income countries (PIIGS) while negative for relatively higher-income countries (core). So, we can conclude that the income inequality is beneficial for transitional growth in poor countries but that it is detrimental for growth in high-income economies.

Summing-up, the impact of Gini to GDP is more significant and negative in the PIIGS. On the other hand, the Gini has a positive impact on the GDP growth in PIIGS, but a negative impact on growth on the Core countries.

Moreover, we can relate these findings with those somehow referred in the former subsection, considering growth as the single mechanism of transmission of fiscal policy to inequality: i) in PIIGS, government spending on health, indirect taxes and social security contributions increase output and, consequently, as output has an inverse link with Gini, Gini will decrease, decreasing income inequality; ii) in core countries, government spending on social protection decreases output and, consequently, barely decreases Gini coefficient.

On the other hand, government spending on education and indirect taxes will increase output and will, consequently increase Gini coefficient, barely increasing income inequality.

4.2. Fiscal multipliers

In the literature, fiscal multipliers tend to assess the impact of fiscal instruments on output. In this regard, there is no consensus on how multipliers (*m*) should be defined. Hjelm and Stockhammar (2016) present three most common options:

- "The peak multiplier", that compares the maximum effect of a variable (*y* in period *h*) of a shock to a variable (*g*) that takes place in period 0, that is:

$$\boldsymbol{m^{max} = \frac{\Delta y_h^{max}}{\Delta g_0}} \qquad \textbf{(4.2.1)}$$

- "The impact multiplier" analyzes the initial effect in period 0:

$$\boldsymbol{m^{imp} = \frac{\Delta y_0}{\Delta g_0}} \qquad \textbf{(4.2.2)}$$

- "The cumulative multiplier" compares the integral of the effect on two variables of a shock:

$$\boldsymbol{m_h^{cum} = \frac{\sum_{t=0}^{h} \Delta y_t}{\sum_{t=0}^{h} \Delta g_t}} \qquad \textbf{(4.2.3)}$$

The cumulative multiplier has subscript *h*, and is thus a vector of cumulative multipliers covering successively longer periods of time (Hjelm and Stockhammar, 2016).

Although the impulse and accumulated impulse response functions are important to assess the impact of budgetary policies in the short, medium and long term, the impulse response outcomes do not correspond to the value of the multiplier. The multiplier calculation results from two distinct components One is the elasticity of output to the budgetary fiscal policy instrument, directly extracted from the outcomes of the impulse response functions. This component is obtained by computing, on the one hand, the impulse response of expenditure or revenue to a shock on itself on impact (one-shot shock) and, on the other hand, the cumulative responses of the output growth to a shock on public expenditure or public revenue over time. The multiplier is then obtained by dividing the

elasticity obtained by the weight of the volume of government expenditures or revenues on GDP in the sample considered (second component of the computation: ratio).

In the tables presented below we can see the value of the elasticities of output to the budgetary fiscal policy instrument and multipliers, as well as the weight of the variable on GDP (ratio). We only calculate the value of the multipliers of the variables which, through the analysis of the impulse responses, are statistically significant. We calculate these values for short-run (using t=0 for government spending side variables and t=1 for government revenue side variables) and long-run (t=5).

Table 6: Elasticities and fiscal multipliers, PIIGS

PIIGS	Short-run		Long-run		
	Elasticity	Multiplier	Elasticity	Multiplier	Ratio
Health	0,1559	2,5288	0,7601	12,3283	6,17%
Indirect Taxes	0,0915	0,6987	0,2048	1,5643	13,09%
SSC	0,0883	0,7886	0,1948	1,7396	11,20%

Table 7: Elasticities and fiscal multipliers, Core countries

Core	Short-run		Long-run (t=5)		
	Elasticity	Multiplier	Elasticity	Multiplier	Ratio
Health	0,0508	0,7217	0,1816	2,5796	7,04%
Education	0,1003	2,0352	0,5144	10,4366	4,93%
Social Protection	-0,6724	-3,2595	-0,5719	-2,7723	20,63%
Economic Affairs	-0,0041	-0,0898	-0,0380	-0,8398	4,53%
Indirect Taxes	0,2620	1,9124	0,5281	3,8540	13,70%

The interpretation of these values is similar for all variables. Will be presented some of them.

On the spending side, starting with PIIGS, on short-run, the elasticity of output with respect to government spending on health is 0,1559. This implies that, a one Euro increase in public spending on health increases output by 2,5288€. On long-run, the elasticity of output with respect to government spending on health is 0,7601. So, it implies that a one Euro increase in public spending on health increase output in the long term by 12,328€. This results are in line with Gnip (2015), that showed that the multiplier associated with government spending is positive and above 2 in short-run and in a long-run, the effects on output are permanent and significant.

In Core countries, on short-run, the short-run elasticity of output with respect to government spending on social protection is -0,6724. This implies that the multiplier is about -3,2595, meaning that, if the government spending on social protection increase one Euro, the output decrease 3,2595€. The long-run multiplier is about -2,7723, meaning that, if the government spending on social protection increase one Euro, the output decrease 2,7723€. These results about government spending on social protection are in line with Afonso and Sousa (2008), showing that the effects on GDP are negative.

So, the multipliers associated with government spending have a Keynesian effect, with an exception regarding to government spending on social protection. In this case, in core countries, the multiplier is negative, showing a non-Keynesian effect. So, in short-run our results are in line with Sen and Kaya (2015) but in long-run this is not the case.

On the revenue side, in PIIGS, in short-run, the elasticity of output with respect to indirect taxes is 0,0915. This implies that a one Euro increment in indirect taxes increase output in short-term by 0,699€. This result are in line with Sen and Kaya (2015), that found that, in short run, the fiscal multiplier associated to taxes appears to be lower than 1 or negative. Regarding to core countries, these multiplier is bigger (1,912).

Now, in long-term, in PIIGS, a one Euro increment in indirect taxes increase output in long-term by 1,564€. In turn, regarding to Core countries, the multiplier is also bigger (3,854), meaning that, a one Euro increment in indirect taxes increase output in long-term by 3,854€. Contrary, Mazar (2011) show that indirect taxes moderates GDP growth. He found that the multiplier associated of indirect taxes is -0.28.

Regarding to direct taxes, the results were contrary to the expected. Only, the study done by Hjelm and Stockhammar (2016) also found an exception regarding to direct taxes, showing that shocks to direct taxes turns non-Keynesian after about one year. That is, a negative shock to direct taxes increase GDP in the short run, but later the multiplier turns non-Keynesian.

4.3. Fiscal "multipliers" in income inequality

In the tables presented below we can see the value of the elasticities of income inequality to the fiscal policy instrument as well as the ratio between the Gini and the value of the fiscal policy instrument.

We only calculate the value of the elasticities of income inequality to the budgetary fiscal policy instrument of the variables which, through the analysis of the impulse responses, are statistically significant.

We calculate these values for short-run (using t=0 for government spending side variables and t=1 for government revenue side variables) and long-run (t=5).

Table 8: Elasticities of income inequality to selected fiscal variables, PIIGS

PIIGS	Short-run	Long-run	Ratio
Education	-0,0311	-0,0611	0,0000120
Others	0,0038	-0,1162	0,0009609
SSC	0,0844	0,0378	0,0000048

Table 9: Elasticities of income inequality to selected fiscal variables, Core Countries

Core countries	Short-run	Long-run	Ratio
Education	0,4034	0,4074	0,000005
Social Protection	-0,2124	-0,4813	0,000001

Regarding to Government Spending on education, in PIIGS, the elasticity on short run, is -0,0311. This means that, if government spending on education increases 1%, the Gini coefficient decrease 0,0311%. On long-run, if government spending on education increases 1%, the Gini coefficient decrease 0,0611%.

In Core countries, we have an opposite and bigger effect. That is, in short run, if government spending on education increases 1%, the Gini coefficient increase 0,4034% and in long run, 0,4074%.

The higher elasticity corresponds to government spending on social protection, in Core countries, in long-run. Its value is -0,4813, meaning that, if government spending on education increases 1%, the Gini coefficient decrease 0,4813%, decreasing the income inequality, as we had conclude before.

5. Conclusions

Over recent years, income inequality has been increasing in many economies and fiscal policies have played a key role in trying to reduce income inequality through instruments as taxes and government expenditures.

This dissertation aims at contributing to the literature on exploring and assessing the relation between alternative fiscal policy instruments, both from expenditure side and revenue side, and income distribution inequality in developed, European countries. To the best of our knowledge, there is no comprehensive review on compared mechanisms of different fiscal policy instruments on income inequality as we intended to do. Because there is still no systematic empirical overview in recent years, we propose to study such relation using more recent data and in developed countries. In particular, we use a panel data set including PIIGS countries compared with the EMU core countries. Finally, while most of the literature usually computes fiscal policy income multipliers, we propose to disentangle income and "inequality multipliers".

From the literature, both theoretical and empirical, regarding to revenue side, most of the authors conclude that direct taxes decrease the income inequality due to their usual progressive structure, while the indirect taxes tend to be regressive, increasing inequality. On the expenditure side, most of the literature conclude that public spending reduce the income inequality. In what regards details by functional classification, there is a consensus that spending on health decreases income inequality. On the other hand, results are ambiguous regarding spending on education and social protection. Moreover, the literature shows that fiscal policies have different impacts in different countries: for example, the impact of taxes and transfers in European developed countries are much stronger than in Latin America developing countries. From the literature review, we also concluded that fiscal policies have a stronger impact and that spending-side instruments play a much more important role in reducing the income inequality in developed economies. However, in developing economies, evidence is rather mixed, with conclusions differing across countries; however, literature shows that fiscal policies in these countries tend to be less redistributive.

In order to assess the impacts of alternative instruments on income and inequality, we followed the methodology used by Ramos and Roca-Sagales (2008), based on a VAR model, covering a set of EMU countries for a time period of 20 years (1996-2015). Given our assumptions, the main results obtained through the VAR estimation were that: i) in PIIGS,

health expenditures, indirect taxes and social security contributions have a positive effect on output while ii) in the EMU core countries, spending on social protection has a negative effect on output, although education spending and indirect taxes have a positive effect; iii) in PIIGS, social security contributions have a positive effect on income inequality, aggravating it, while spending "others" has a negative effect, decreasing income inequality; iv) in the core countries, where spending on social protection has a negative effect on inequality, spending on education has a positive effect, increasing inequality; v) finally, the link of GDP to Gini is more significant and negative in the group of PIIGS and, on the reverse causality, the Gini has a positive impact on the GDP growth in PIIGS, but a negative impact on the growth rate of the core countries.

When considering growth as the single mechanism of transmission of fiscal policy to inequality: i) in PIIGS, government spending on health, indirect taxes and social security contributions increase output and, consequently, as output has an inverse link with Gini, Gini and income inequality decrease; ii) in core countries, government spending on social protection decreases output and but barely decreases Gini coefficient. On the other hand, government spending on education and indirect taxes will increase output and will, consequently, barely increase income inequality.

Moreover, we also computed fiscal multipliers for which impulse responses on output were statistically significant, and we concluded that the multipliers associated with government spending have a Keynesian effect, with the exception of government spending on social protection. In what regards multipliers associated with government revenue, they exhibit non-Keynesian effects. On spending side, the higher fiscal multiplier is associated with health spending on PIIGS, and in regards to core countries, the higher fiscal multiplier is associated with education spending. On revenue side, the higher fiscal multiplier is associated with SSC on PIIGS, and in regards to core countries, the higher value is associated with indirect taxes. This implies that, these instruments have a stronger impact on increasing the output.

We also presented the elasticities of income inequality to the fiscal policy instrument of the variables that are statistically significant. On core countries, these values are higher, meaning that, the instruments have a much stronger impact in this group of countries.

Our results show that, as stated in the literature, there is a disparity in the effects of spending on education in income inequality: it increases inequality in core countries (although slightly significant) and decreases in PIIGS. Additionally, in PIIGS, spending on "Others" is

the most effective for reducing inequality and social spending are important to reduce inequality but only in core countries.

In sum, as political recommendations to reduce inequalities and promote growth, it will be required, for example, Governments to promote measures to encourage investment in education and training throughout life. In regards to taxation, in order to aggravate the burden of the richest and create income support of the poor, both workers and unemployed, governments should reconsider their programs and strengthen their design, recognizing that redistribution plays a very important role.

As we can see, there is little literature assessing the links between different components of Government spending and income inequality, particularly with regards to health spending. Regarding education spending this does not happen, as there is some literature; however, there are mixed opinions across the authors.

In addition, some results did not come as expected (namely the impact of direct taxes on output) and the statistical significance of most of the IRF was too low to provide robust conclusions. Considering a larger sample, including several developed countries and other, less developed countries, would possible provide better insights on the different impacts of fiscal policies on inequality across countries with substantially different structural characteristics. We found some differences between PIIGS and core, but, on the one hand, countries are rather homogeneous, and the number of observations, due to data availability is too short.

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Annexes

Table 1A: Descriptive statistics - PIIGS

	SOCIAL_PROTECTION	GENERAL_PUBLIC_SERVICES	EDUCATION	HEALTH	ECONOMIC_AFFAIRS	OTHERS_GS	GDP	GINI	INDIRECT_TAXES	DIRECT_TAXES	SSC
Mean	100807.2	50410.08	26709.41	37869.08	28510.31	34476.43	614232.2	0.331323	80410.26	75578.92	68776.71
Median	34269.37	23775.28	11665.61	13233.27	11703.42	12105.06	207102.1	0.330000	28967.52	19761.97	20371.81
Maximum	330418.9	199835.7	76841.44	119419.4	84573.18	96435.02	1687143.	0.381000	244402.3	253004.1	216319.5
Minimum	10552.57	5833.876	4076.510	4685.087	3242.780	3908.127	86639.67	0.288000	13076.57	10364.08	979.1965
Std. Dev.	105375.2	54093.14	24193.32	37323.15	25349.28	32198.73	571912.9	0.021297	78851.88	82526.99	75024.80
Skewness	1.003776	1.238598	0.829261	0.974529	0.629133	0.662866	0.739832	0.149387	1.048187	1.031225	0.761230
Kurtosis	2.470132	3.177553	2.097758	2.450178	1.745613	1.722395	1.869789	2.685509	2.540692	2.461148	1.961851
Jarque-Bera	19.75886	28.27011	16.33838	18.79685	14.46831	15.53677	15.88943	0.862448	21.10966	20.82695	15.56333
Probability	0.000051	0.000001	0.000283	0.000083	0.000722	0.000423	0.000355	0.649713	0.000026	0.000030	0.000417
Sum	11088790	5545109.	2938036.	4165599.	3136134.	3792408.	67565537	36.44550	8845129.	8313681.	7565438.
Sum Sq. Dev.	1.21E+12	3.19E+11	6.38E+10	1.52E+11	7.00E+10	1.13E+11	3.57E+13	0.049438	6.78E+11	7.42E+11	6.14E+11
Observations	110	110	110	110	110	110	110	110	110	110	110

Table 2A: Descriptive statistics – Core countries

	SOCIAL_PROTECTION	GENERAL_PUBLIC_SERVICES	EDUCATION	HEALTH	ECONOMIC_AFFAIRS	OTHERS_GS	GDP	GINI	INDIRECT_TAXES	DIRECT_TAXES	SSC
Mean	223049.0	74638.11	53289.81	76083.58	49001.06	65987.99	1081228.	0.268877	148164.0	132675.4	144277.6
Median	89796.47	35418.28	31480.17	37179.78	25276.34	39111.80	603222.0	0.269165	71883.82	60168.68	79290.13
Maximum	563759.0	176735.4	123207.4	209782.7	263877.0	564135.4	2855352.	0.308000	414179.4	363445.8	354976.6
Minimum	30922.50	10356.25	8530.000	7641.250	7483.579	6800.000	123400.0	0.220000	17553.96	20365.83	16754.77
Std. Dev.	202298.0	64221.76	43828.04	67448.00	43580.65	71616.20	944724.5	0.019531	133868.0	113116.2	123393.8
Skewness	0.493619	0.445301	0.372792	0.495171	1.336204	3.154274	0.514245	-0.130053	0.549692	0.534967	0.409186
Kurtosis	1.388501	1.346934	1.268980	1.502834	6.335388	22.06808	1.562121	2.914796	1.583378	1.505250	1.360462
Jarque-Bera	16.36970	16.15991	16.28150	14.76880	83.72184	1848.868	14.32425	0.343361	14.73754	15.48724	15.38999
Probability	0.000279	0.000310	0.000291	0.000621	0.000000	0.000000	0.000775	0.842248	0.000631	0.000433	0.000455
Sum	24535385	8210192.	5861879.	8369194.	5390117.	7258679.	1.19E+08	29.57650	16298044	14594297	15870538
Sum Sq. Dev.	4.46E+12	4.50E+11	2.09E+11	4.96E+11	2.07E+11	5.59E+11	9.73E+13	0.041578	1.95E+12	1.39E+12	1.66E+12
Observations	110	110	110	110	110	110	110	110	110	110	110